

## 1 Figure S1

Unfiltered Hövmoller plots of zonal wind perturbations from the zonal-mean at 16 km for the December 2019 - April 2020 disruption time period, for (a) Aeolus and (b) ERA5 as Aeolus. The 3 dashed magenta lines during the period of the disruption correspond to the cross-sectional snapshots in Fig. 7. The vertical dashed green lines mark the longitude of the Singapore radiosonde launch site,  $104^\circ$ . Data is interpolated onto a  $2^\circ$  resolution longitude grid to match the format of Fig. 6.

## 2 Animated Figure S2

Animation of vertical along-equator cross-sections of the daily averaged zonal wind perturbation from the zonal-mean between  $2.5^\circ\text{N}$  and  $2.5^\circ\text{S}$  for the period 2019-12-01 - 2020-04-01. A 5 to 25 day Gaussian bandpass filter is used to highlight Kelvin waves. Data is interpolated onto a  $2^\circ$  resolution longitude grid to match the format of Fig. 7.

## 3 Figure S3

Wavenumber-frequency power spectra for the (top) symmetric component, at 18 km altitude at the equator and (bottom) antisymmetric component, at 19 km at  $7.5^\circ\text{S}$ , for (left) Aeolus, (right) ERA5 and (middle) Aeolus - ERA5. Also plotted are theoretical dispersion curves for Kelvin waves,  $n = 1$  equatorial Rossby (ER) waves and mixed Rossby-gravity (MRG) waves with equivalent depths  $h_e = 12$  m, 25 m and 50 m. Same as plotted in Fig. 9 but without instrument noise removal or scaling by the wave amplitudes. Stippling from Fig. 9 is not shown.